pg. 153

#3 $y = \cos(\sqrt{3}\, x)$

$y' = -\sin(\sqrt{3}\, x)\sqrt{3}$

$= -\sqrt{3}\sin(\sqrt{3}\, x)$

(5) $y = \left(\frac{\sin x}{1+\cos x}\right)^2$

$$y' = 2\left(\frac{\sin x}{1+\cos x}\right)\left(\frac{\cos x(1+\cos x) - \sin x(-\sin x)}{(1+\cos x)^2}\right)$$

$$\cos x + \cos^2 x + \sin^2 x$$

$$= 2\left(\frac{\sin x}{1+\cos x}\right)\left(\frac{1+\cos x}{(1+\cos x)^2}\right)$$

$$= \frac{2\sin x}{(1+\cos x)^2}$$

$$y = 5\cot\left(\frac{2}{x}\right) = 2x^{-1}$$

$$y' = 5\left(-\csc^2\left(\frac{2}{x}\right)\right)\left(-2x^{-2}\right)$$

$$= \frac{10\csc^2\left(\frac{2}{x}\right)}{x^2}$$

⑦ $y = \cos(\sin x)$

$y' = -\sin(\sin x) \cdot \cos x$

$= -\cos x \sin(\sin x)$

⑧ $y = \sec(\tan x)$

$y' = \sec(\tan x)\tan(\tan x)\sec^2 x$

(13) $(x+\sqrt{x})^{-2}$

$$y' = -2(x+\sqrt{x})^{-3}\left(1+\frac{1}{2}x^{-\frac{1}{2}}\right)$$

$$= -2(x+\sqrt{x})^{-3}\left(1+\frac{1}{2\sqrt{x}}\right)$$

(14) $y = (\sec x + \cot x)^{-1}$

$$y' = -1(\csc x + \cot x)^{-2}(-\csc x \cot x - \csc^2 x)$$

$$= \frac{-1(-\csc x(\cot x + \csc x))}{(\csc x + \cot x)^2}$$

$$= \frac{\csc x}{\csc x + \cot x}$$

(15) $y = \sin^{-5} x - \cos^3 x = (\sin x)^{-5} - (\cos x)^3$

$y' = -5\sin^{-6} x \cdot \cos x - 3\cos^2 x(-\sin x)$

$= -5\sin^{-6} x \cos x + 3\cos^2 x \sin x$

$y = (\sin x)^{-5}$

$y = (u)^{-5}$ $\quad y' = -5u^{-6} \cdot u'$

$u = \sin x$ $\quad = -5\sin^{-6} x \cdot \cos x$

(16) $y = x^3(2x-5)^4$

$y' = 3x^2(2x-5)^4 + x^3\left(4(2x-5)^3(2)\right)$

$= 3x^2(2x-5)^4 + 8x^3(2x-5)^3$

$= x^2(2x-5)^3\left(3(2x-5) + 8x\right)$

$= x^2(2x-5)^3(6x-15+8x)$

$= x^2(2x-5)^3(14x-15)$

(17) $y = \sin^3 x \tan 4x$

$y' = 3\sin^2 x \cos x \tan 4x + \sin^3 x \sec^2 4x \cdot 4$

$= 3\sin^2 x \cos x \tan 4x + 4\sin^3 x \sec^2 4x$

(18) $y = 4(\sec x + \tan x)^{\frac{1}{2}}$

$y' = 2(\sec x + \tan x)^{-\frac{1}{2}}(\sec x \tan x + \sec^2 x)$

$= \dfrac{2(\sec x(\tan x + \sec x))}{(\sec x + \tan x)^{\frac{1}{2}}}$

$= 2\sec x \sqrt{\tan x + \sec x}$

(19) $y = 3(2x+1)^{-\frac{1}{2}}$

$y' = -\frac{3}{2}(2x+1)^{-\frac{3}{2}}(2)$

$= -3(2x+1)^{-\frac{3}{2}}$

$= \frac{-3}{(2x+1)^{\frac{3}{2}}}$

(20) $y = \dfrac{x}{\sqrt{1+x^2}} = \dfrac{x}{(1+x^2)^{\frac{1}{2}}}$

$$y' = \frac{(1)(1+x^2)^{\frac{1}{2}} - (x)\left(\frac{1}{2}(1+x^2)^{-\frac{1}{2}}(2x)\right)}{\left((1+x^2)^{\frac{1}{2}}\right)^2}$$

$$= \frac{(1+x^2)^{\frac{1}{2}} - x^2(1+x^2)^{-\frac{1}{2}}}{1+x^2}$$

(23) $y = (1 + \cos^2 7x)^3$

$y' = 3(1 + \cos^2 7x)^2 (2\cos 7x)(-\sin 7x)(7)$

$= -42(1 + \cos^2 7x)^2 \cos 7x \sin 7x$

(24) $y = \sqrt{\tan 5x} = (\tan 5x)^{\frac{1}{2}}$

$y' = \frac{1}{2}(\tan 5x)^{-\frac{1}{2}} \sec^2 5x \cdot 5$

$= \frac{5}{2}(\tan 5x)^{-\frac{1}{2}} \sec^2 5x$

(26) $r = \sec 2\theta \tan 2\theta$

$r' = \sec 2\theta \tan 2\theta \cdot 2 \cdot \tan 2\theta + \sec 2\theta \sec^2 2\theta \cdot 2$

$= 2\sec 2\theta \tan^2 2\theta + 2\sec^3 2\theta$

(27) $r = (\theta \sin\theta)^{\frac{1}{2}}$

$r' = \frac{1}{2}(\theta \sin\theta)^{-\frac{1}{2}}\left(1(\sin\theta) + \theta\cos\theta\right)$

$= \dfrac{\sin\theta + \theta\cos\theta}{2\sqrt{\theta \sin\theta}}$

(28) $r = 2\theta(\sec\theta)^{\frac{1}{2}}$

$r' = (2)(\sec\theta)^{\frac{1}{2}} + (2\theta)\left(\frac{1}{2}\sec\theta\right)^{-\frac{1}{2}}(\sec\theta\tan\theta)$

$= 2\sqrt{\sec\theta} + \dfrac{\theta\sec\theta\tan\theta}{\sqrt{\sec\theta}}$

$= 2\sqrt{\sec\theta} + \theta\sqrt{\sec\theta}\tan\theta$

$= \sqrt{\sec\theta}(2 + \theta\tan\theta)$

(31) $y = \cot(3x-1)$

$y' = -\csc^2(3x-1)(3)$

$y' = -3\csc^2(3x-1)$

$y'' = -6\csc(3x-1)\left(-\csc(3x-1)\cot(3x-1)\right)^3$

$= 18\csc^2(3x-1)\cot(3x-1)$

(32) $y = 9\tan\left(\frac{x}{3}\right)$

$y' = 9\sec^2\left(\frac{x}{3}\right)\left(\frac{1}{3}\right)$

$y' = 3\sec^2\left(\frac{x}{3}\right)$

$y'' = 6\sec\left(\frac{x}{3}\right)\cdot\sec\left(\frac{x}{3}\right)\tan\left(\frac{x}{3}\right)\left(\frac{1}{3}\right)$

$= 2\sec^2\left(\frac{x}{3}\right)\tan\left(\frac{x}{3}\right)$